UTAH'S COMPUTER GRAPHICS INDUSTRY
AN ECOSYSTEM THREE DECADES IN THE MAKING
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Utah's computer graphics "ecosystem" was not built overnight. The story of the creation, evolution, and continued sustainability of this industry--a large subset of and catalyst for the entire digital media industry sector in Utah--is not only a fascinating case history, but might also hold valuable lessons for other technology ecosystems.

The Utah Technology Alliance (UTA) is in the midst of identifying economic "ecosystems" within the Utah technology sector. An economic ecosystem is an economic sector where key resources are available to sustain and grow the system. It consists of core technologies, supported by ideas, capital, research, people, businesses, and the regulatory environment. Utah's initial official ecosystem map, unveiled in January, includes a broad ecosystem encompassing all "digital media."

"Utah clearly was the birthplace of the modern-day computer graphics industry," says UTA director Rod Linton. "There's a whole group of University of Utah students who have gone on to become major players in the digital media industry. The challenge for Utah has been that many of those people did most of their very creative and entrepreneurial work outside the state, primarily in California. As a result, Utah's presence in the graphics industry hasn't remained as strong as it was in the early days."

Linton cites three areas in which the state might re-emerge as a powerhouse in the computer graphics arena: entertainment software, visualization, and cinematic post-production.

BIRTH OF A COMPANY, ORIGINS OF AN ECOSYSTEM

The seeds of today's computer graphics industry were planted in 1963 when David Evans became the chair of the University of Utah's new Computer Science department, one of the first in the country. Evans had returned to Salt Lake City (from Berkeley) with the intention of building a world-class department, largely dedicated to research in his areas of interest: computer graphics and human-computer interaction.

It was a time of excitement and opportunity in the nascent computer industry. Evans' ability to recognize talent and provide research resources created an environment that launched the careers of some of today's brightest in the industry, including Alan Ashton (co-founder of WordPerfect); Nolan Bushnell (founder of Atari and creator of Pong, the first video game); Jim Clark (founder of Silicon Graphics and co-founder of Netscape); Ed Catmull (co-founder and president of PIXAR); Alan Kay (known for his pioneering graphical user interfaces work at Xerox PARC and Apple); and John Warnock (co-founder of Adobe Systems).

At the same time Evans was setting up the department at the "U," Ivan Sutherland was doing groundbreaking research at MIT and Harvard, which helped establish the viability of graphics and turn computers into visual thinking tools.

Evans and Sutherland knew one another and were equally frustrated that their advice to business and government often went unheeded. In 1968, Sutherland agreed to move from Cambridge to Salt Lake to co-found the Evans & Sutherland Computer Corporation (E&S).

In those early days, there was essentially a revolving door between E&S and the University, which resulted in a dynamic, ongoing interchange of ideas and people. Sutherland was president of E&S and a "U" professor, while Evans remained as the full-time chairman of the Computer Science Department.

E&S' first customers were research institutions in the market for high-cost, one-of-a-kind graphics systems that tested the limits of existing capabilities. Rod Rougelot and Bob Schumacker, who had been involved in early visual simulator sales to NASA in 1963 while still at General Electric, largely established the E&S simulation division. Rougelot later went on to became CEO of E&S after Evans retired.

In subsequent years, E&S established a name for itself by creating believable, synthetic environments in their virtual reality simulators that were used for training personnel in the operation of aircraft, ships, helicopters, tanks, and rocket ships--and the world beat a path to their door.

Another division of E&S--interactive systems--made forays into other graphics niches, including newspaper production hardware, supercomputers, computer-aided design soft-ware, molecular modeling tools, engineering graphic workstations, virtual studio sets for television production, and computer graphic boards and chips. Many of these efforts were technology-driven rather than market-driven. As a result, some of these spin-offs helped stimulate other companies and endeavors, while never becoming commercially viable businesses for E&S.

EVOLUTION AND GROWTH

The energy and synergism that existed between the "U" and E&S during the 1960's carried over into '70s and '80s, drawing ideas and people toward further cutting-edge computer graphics research and applications. However, bright and creative people often have limited attention spans, and the fertility of other technology projects and environments, including Silicon Valley and the Boston area, began to call to many of those who had been nurtured in the Utah technology climate. John Warnock, who had been working from Mountain View, California, decided to leave the company rather than return to Utah. More recently, Microsoft Research has drawn a number of computer graphics luminaries away from the University.

Rapid advances in computing speed also took their toll on E&S, as applications previously requiring a $60,000 specialized workstation could be done with a standard PC equipped with a sub-$1000 3D graphics board. As graphics chips became a commodity, E&S became a less desirable supplier.

In recent years, E&S has explored business markets beyond real-time operator training, adding relatively inexpensive PC-based systems with commercially available graphics chips and expanding detailed, accurate database products. In October 2001, however,

the company announced it was returning to its core visual simulation business and sold off extraneous operations.

THE E&S LEGACY AND THE SEEDS OF THE ENTERTAINMENT SOFTWARE INDUSTRY

As E&S matured, it spawned other companies whose co-founders were once employees. Many of the start-ups that have remained in Utah are today's crop of digital video game companies. National press outlets, focusing on Utah for Olympics coverage, have taken note of the entertainment software industry in Utah because even on its own, it is a microcosm of the Utah technology environment.

Computer games are currently big business, eclipsing Hollywood movie box-office receipts with sales of $8.2 billion in 2000. One industry trade group, Interactive Digital Software Association (IDSA), estimates that about 145 million people (60 percent of Americans) now play computer or video games. Game developers in Utah hope to reap the benefits of the growing entertainment software market. Soundview Technology analysts predict sales of game consoles will jump to $9.7 billion in 2002, with software purchases (i.e. the games) growing to $20 billion.

UTAH INDUSTRY PLAYERS

Many entertainment software companies today can trace their lineage to E&S, Access Software or Sculptured Software.

Access Software, perhaps best known for its popular Links golf game, was founded by Utahn Bruce Carver in 1982. The company was acquired by Microsoft in 1999 and is currently producing software titles for the Xbox platform, including a popular Brighton Resort snowboard game.

Another pioneering Utah game company, Sculptured Software, was founded by George Metos. Acquired by Acclaim Entertainment in 1994, it continues to operate in Salt Lake City. Employees of Sculptured Software have been prolific in starting new gaming companies including Kodiak Interactive, Avalanche Software, and Saffire Software.

In 1995, several former E&S employees started SingleTrac, which created games for the then-new Sony PlayStation before being bought by GT Interactive in 1998. As often happens, the group moved operations from Salt Lake City. From the remains of this company came Incognito Entertainment in 1999, which creates games for the Sony Playstation 2.

Despite the industry's growth and success, consolidation is occurring and competition is stiff. "It costs over $3 million to create a next-generation game for the PlayStation 2 or Xbox," says Incognito founder and President Scott Campbell. "As a result, game publishers are being more selective. They're not contracting for as many titles, and they are going after developers who have a proven track record with hit products. We are fortunate to have a good track record and a great relationship with Sony."

American Fork-based Saffire Software was founded in 1994 by Les Perdew and Hal

Rushton, who left Sculptured Software after the Acclaim acquisition. Saffire develops a diverse set of multi-platform games that can be run on the Xbox, PlayStation 2, and Nintendo GameCube. Saffire also creates Nintendo Gameboy Advanced titles, including a recently released game and animation CD for Lego.

"For a city its size, the Salt Lake City (entertainment software industry) is large," says Brett Nord, business development manager at Saffire, who compares the size of the industry to that of Austin, Texas. Nord, who moved to Utah last September, typically sees large numbers of developers in those cities where there are game publishers. Publishers take the brunt of the marketing risk, and it's their name on the box; they generally outsource game creation to the developers. Currently, there are no Utah-based game publishers.

UTAH'S ENTERTAINMENT SOFTWARE CULTURE

Lest one think Salt Lake City's Research Park is the only place to find computer graphics jocks, one need only look to Saffire and Incognito. Says Nord, "Because of our Utah County location, we can pull in a lot of talent from BYU. Our art director is a BYU art professor; he's been able to recruit top talent from his classes to come work for us."

Saffire also recruits outside Utah to bring in diversity of experience and perspective. Nord explains, "We are continually trying to bring in outside talent so we can incorporate their ideas into our company and our projects."

Every industry leader interviewed agreed it is essential for the success of a regional industry to facilitate the exchange of information between software engineers for which areas such as Silicon Valley are known. Nord recalls informal power lunches organized by Electronic Arts in Dallas once a month: "Even though we were competitors on one level, we would meet to talk about industry issues, buyers, problems, and to commiserate with each other about how hard it is to work with certain people! I haven't seen that sort of network here yet."

Informally, people involved in local graphics technology tend to know each other and keep in touch as they move to other companies. Says Incognito's Campbell, "We try not to raid each other; we extend each other that courtesy. I think even the recruiters respect the fact we're all trying to coexist. As an industry, we do keep tabs on what's happening in the industry, and potential sources of good talent."

Additionally, a wide variety of disciplines are collaborating together to bring computer graphics into their specific domains. It is generally felt that the state's new "ecosystem" branding campaign acknowledges and promotes this mindset through the motto: "Where ecosystems connect, new industries are born."

WISDOM AND VISION THROUGH COMPUTER VISUALIZATION

Compared to gaming, the visualization industry and the Utah companies in this field are nascent. They tend to defy categorization because the term "visualization" means different things to different people.

According to Chuck Hansen, a University of Utah associate professor of computer science, "Visualization efforts and projects take data, typically scientific data, and generate meaningful imagery through the use of computer graphics. These provide insight into the meaning of data for scientists, doctors--or anyone else, for that matter."

Hansen came to the "U" in 1997 from Los Alamos National Laboratory, where he did research on the visualization of very large data sets. "I came here because I believe that the faculty and the University of Utah have the potential to make significant research contributions to the graphics and visualization fields."

The faculty Hansen refers to includes Chris Johnson, director of the Scientific Computing and Imaging Institute (SCI); Peter Shirley, who does research on image synthesis (the art and science of generating realistic looking imagery based on physical principles); and Rich Riesenfeld and Elaine Cohen, who collaborate on research and development of computer-aided manufacturing and design innovations.

The SCI Institute is currently involved in a research project funded by the Department of Energy, which is bringing together multi-disciplinary sciences in the School of Computing and the Departments of Mechanical Engineering, Chemical and Fuels Engineering, and Chemistry to work on combustion modeling and the simulation of fires and explosions.

This demonstrates the willingness of faculty in far-flung departments at the "U" to stray across traditional department lines and become involved in projects in computer graphics.

Says Hansen, "Faculty with research training and expertise in other domains have incorporated graphics applications into their own research, which exemplifies the expanding role of visualization in many areas. I think the graphics program at the 'U' is in one of the most prolific stages it's been in since the early days, based upon the broad interests of the faculty we have and the broad view we collectively take of computer graphics."

Few would disagree that computer graphics research at the "U" is world-class. The program is part of a distributed National Science Foundation (NSF) Center for Computer Graphics and Visualization that places it in the distinguished company of four other powerhouse graphics programs around the country. At the "U" 11 faculty members are focused mainly on computer graphics.

Other institutions in Utah are also notable for their strong programs in computer science and computer arts. According to Rich Riesenfeld, a professor at the "U" and director of the NSF Science and Technology Center for Computer Graphics and Visualization, "To me it's clear that education is a critical long-term investment. If you look at why Utah is a graphics center, it's because we are reaping the returns of investments made over 25 years ago when this industry began."

COMMERCIALIZING VISUALIZATION RESEARCH

Those contemplating whether lightning may strike twice and give Utah another chance to excel commercially in computer graphics might consider Visual Influence (VI), a startup spun off from the visualization research of the SCI Institute. There are striking parallels

between this company and the start-up days of E&S: both rely on close synergy between students, researchers and employees on both sides of the industry/academia line.

The Company's first commercial product, SCIRun, is intended for use by applied scientists, engineers, and medical practitioners, rather than researchers. VI is perhaps further along the product development pipeline than was E&S when they started. VI has already hired a full-time CEO with a business background, rather than an aspiring technologist who might retain heavy academic commitments.

Other current commercialization opportunities stem from a growing confluence between "computer vision" and computer graphics. Computer vision (sometimes called "scene understanding") can be described as the "other side" of the visualization equation: whereas graphics research endeavors to create an image, computer vision focuses on making sense of what is being observed--image analysis, understanding and recognition.

These two camps have traditionally been separate communities, pursuing different approaches and developing different techniques, but recently there has been increasing cross-pollination and fundamental connections between them. Conjoint conferences and meetings indicate that the excitement and productivity in these fields will only continue to grow.

University students are beginning to take advantage of this cross-disciplinary collaboration. A new computer animation-oriented student chapter of the international computer graphics professional association ACM SIGGRAPH at the "U" has attracted students from a wide variety of disciplines including anthropology, arts technology, communications, computer science, film, fine arts and theatre.

Divisions and boundaries between disciplines are also becoming less well defined. According to SIGGRAPH chapter chair Hope Eksten, a University of Utah film studies major, "I consider programming to be an art form. A lot of art out there is technical ability--being able to communicate what's in your heart or mind through the tools you have. I have found myself less willing or able to define what art is. I think that term is getting broader, as judged by what artists and scientists are doing."

Hansen agrees: "In my mind, there is a renaissance of graphics occurring, as faculty actively reach out to other disciplines, providing expertise and seeking new applications."

This viewpoint is endorsed from within the Utah software entertainment community as well. Incognito CEO Campbell observes, "Computer graphics has long been noted for its blend of technology and art skills. Our company is comprised of individuals with many different backgrounds; many were students of art or computer science."

GROWTH IN UTAH CINEMATIC POST-PRODUCTION

Utah has long been a place where movies are filmed. Yet in most cases, after the shooting is over, the film companies and camera crews pack up and leave for home, leaving the state with little more than a visual record of the visit.

There is movement afoot to establish Utah as a location for the post-production of digital

film and media. Many indigenous pieces are in place: a large talent pool, strong software development capabilities, close proximity to locally produced media, and relative proximity to the industry production houses in California. Dramatic growth in high-end film post-production work in Utah is entirely possible.

"We export a lot of talent in this area, but we have a very strong film industry in Utah," says UTA director Linton. "There is a strong desire among many film producers here in Utah to extend our capability into all of the technologies related to post-production: certainly animation and special effects would be large pieces of this, and virtual reality is a natural fit because of our computer graphics industry heritage."

Leigh von der Esch, Director of the Utah Film Commission, concurs. "When you start a new industry, it's capital that makes a difference." She cites several examples of efforts to kick-start digital post-production, including a new initiative at Salt Lake Community College that combines computer graphics and post-production, and a proposed media Utah Fairpark campus complete with a production area.

There is some ways to go before that time arrives, however. Chris Drysdale, co-creative director at Euro RSCG DSW Partners, a prominent Utah branding and ad agency that produces television spots, admits, "Whenever we get really serious about animation or 3D special effects, we go to LA."

According to Wasatch Front SIGGRAPH chair and SCI Institute researcher Richard Coffey, "The best Ph.D. grads go to the large, established animation and rendering houses"--such as Industrial Light and Magic, PDI/Dreamworks, PIXAR and Disney Studios--to push the graphics envelope.

The increasing attention devoted to adding value to the computer graphics industry in Utah may contribute to reversing these trends.

THE FUTURE

Perhaps the most exciting aspects of the future of computer graphics goes beyond the creation of artificial worlds and Hollywood "gee-whiz" special effects for their own sake. The defining moments for the industry will arrive when computer graphics techniques become so embedded into everyday life that they become invisible and taken for granted.

At that point, technology and representation will be inseparable from the application or problem for which they were applied. Computer graphics may reach its greatest achievement when no one talks of a "computer graphics" industry.

What will these applications look like? Some of them may be as simple as retrieving a 3D map from the Web to immerse yourself in learning your way around a city, or using virtual reality to collaborate with distant design partners.

"I'll call it the virtual design roundtable," says Riesenfeld of a current research project. "Users will be able to design in one place, critique in another, kibbutz from a third, and manufacture in a fourth."

This could also be applied to allow medical interns to practice a new surgical technique, while an experienced surgeon across the country guides their hands in a virtual immersive environment.

Today's powerful and inexpensive graphics may well spur unimagined future discoveries by making those resources accessible to a broader range and number of researchers. Adds Riesenfeld, "That's partly why the graphics community has grown so large so fast. It's not like in the 1970s where if you wanted to work on computer graphics, you had to have a rich uncle to do it."

To quote the Microsoft Research Graphics group Website, "We believe that interactive three-dimensional graphics and animation will be an important part of future user interfaces directed toward business, consumer, and entertainment applications."

What is the lesson for the Utah technology community? Perhaps Alan Kay said it best: "The best way to predict the future is to invent it." *iQ*